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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/603,375	06/25/2003	Jong Goo Jung	30205/39379	2815
4743	7590	08/10/2004	EXAMINER	
MARSHALL, GERSTEIN & BORUN LLP 6300 SEARS TOWER 233 S. WACKER DRIVE CHICAGO, IL 60606			HUYNH, YENNHU B	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 08/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/603,375

Applicant(s)

JUNG, JONG GOO

Examiner

Yennhu B. Huynh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 6/25/03.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 6/25/03.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

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## **DETAILED ACTION**

### ***Priority***

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### ***Information Disclosure Statement***

The information disclosure statement 6/25/03 is being considered by the examiner.

### ***Oath/Declaration***

Oath/Declaration filed on 6/25/03 is accepted.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1,9,10 & 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Admitted Art (APA) in view of Lee et al. (US. 6,436,834B1).

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APA at pages 1-3 and figs. 1A-1G disclose:

Regarding claims 1, 10 & 19, forming a conductive material 2 for a wordline on a semiconductor substrate 1 (fig. 1B); forming a word line pattern by depositing a hard mask nitride film 3 on an overlapping portion of the conductive material for the wordline (fig. 1B); forming a nitride spacer 5 on a sidewall of the wordline pattern (fig. 1B); forming a planarized interlayer insulating film 7 on the upper portion of the wordline pattern; forming a contact hole by etching the interlayer insulating film when the substrate is exposed (fig. 1c); forming a silicon layer 9 on the surface of the interlayer insulating film where the contact hole is formed on (fig. 1E); performing a primary hard pad CMP process on the silicon layer 9 using a first slurry for an oxide film until the interlayer insulating film is exposed (fig. 1F); forming a second CMP process on the silicon layer and the interlayer insulating film using a second hard pad CMP slurry for an oxide film including a solvent and an  $\text{Al}_2\text{O}_3$  abrasive dispersed in the solvent.

However, APA does not disclose wherein the second CMP performed with an alkyl ammonium salt ( $\text{R}_{(4-n)}\text{H}_n\text{N}^+\text{X}^-$  wherein n is an integer ranging from 0-3).

Lee et al. disclose a chemical mechanical abrasive composition, which include the use of chemical mechanical abrasive composition of alkyl ammonium salt (col. 3 lines 39-63), wherein the X is electrons, R is independently alkyl, and ceria-based is integer ranging of amino alkyl, and wherein the n is an integer ranging from  $\text{C}_1$ - $\text{C}_6$  (col. 4 lines 26-43).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine Lee et al.'s CMP performed with an alkyl ammonium

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salt , wherein n is an integer ranging from 0-3, into the APA, to obtain a high affinity to the oxide film by the n integer low ranging, and enhance abrasion rate in any abrasion basic condition.

Regarding claim 9: APA also disclose wherein the abrasive is a colloidal or fumed SiO<sub>2</sub>, but APA do not disclose is a colloidal or fumed SiO<sub>2</sub>a particle size ranging from 50 – 300nm.

With respect to the particle size ranging is noted that the specification contains no disclosure of either the critical nature of the claimed size of any unexpected results arising therefrom. Where patentability is aid to be based upon particular chosen size or upon another variable recited in a claim, the Applicant must show that the chosen size is critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed.Cir.1990).

Furthermore the dimension of the particle size ranging is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art, As noted In re Aller 105 USPQ233, 255 (CCPA 1955). the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to expected that a change in temperature, or in range, concentration, cycles, thickness, would be an unpatentable modification. Under some circumstance, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art ... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality ... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

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Claims 2-8, 11, 12 & 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Admitted Art (APA) in view of Lee et al. (US. 6,436,834B1) and Nojo et al. (6,443,811B1).

APA and Lee et al. disclose substantially all of the claimed features, but do not disclose wherein the R of the alkyl ammonium salt is selected from the group consisting of linear C<sub>10</sub>-C<sub>50</sub> alkyl and branched C<sub>10</sub>-C<sub>50</sub> alkyl (cl. 2); is selected from the group consisting of linear C from the group consisting of linear C<sub>10</sub>-C<sub>20</sub> alkyl and branched C<sub>10</sub>-C<sub>20</sub> alkyl (cl.3); is selected from the group consisting of F, Cl, Br, I, CO<sub>3</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup> and SO<sub>4</sub><sup>2-</sup> (cl.5); and is selected from the group consisting cetyltrimethylammonium chloride, dodecylethyldimethylammonium bromide, oleyltriethylammonium bromide and didecyldimethylammonium phosphate (cl. 6).

Regarding claims 2, 3, 5 & 6: Nojo et al. disclose an aqueous based ceria slurry system, which include the use of alkyl ammonium salt is selected from the group consisting of linear C<sub>10</sub>-C<sub>20</sub> alkyl or C<sub>10</sub>-C<sub>50</sub> alkyl and branched C<sub>10</sub>-C<sub>50</sub> (col. 3 lines 41-54); wherein the alkyl ammonium salt is selected from the group consisting of bromide (col. 3 lines 44-46); and wherein alkyl ammonium salt is selected from the cetyltrimethylammonium chloride, dodecylethyldimethylammonium bromide, oleyltriethylammonium bromide and didecyldimethylammonium phosphate. (col. 4 table 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine Nojo et al. 's alkyl ammonium salt having specific range of the surfactant ceria based alkyl added and cetyltrimethylammonium chloride, or

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dodecylethylmethylammonium bromide compound, into the APA and Lee et al., because the cationic surfactant in ceria based from those compounds will neutralize the alkaline solvent solution, and absorb onto the silicon surface, therefore it will reduce the rate of surface defects or scratches during the etching process.

APA and Lee et al. also do not disclose wherein the R includes an unsaturated alkyl group having at least one or more of double bond or triple bond (claim 4).

Regarding claim 4: Nojo also disclose wherein the R include an unsaturated alkyl group having at least one or more of triple bond such as trimethylammonium (table 1, col. 4).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine Nojo et al.'s alkyl ammonium salt having triple bond, into the APA and Lee et al., to obtain strong chemical absorb onto the silicon surface and prevent the growth of surface defects or scratches.

Regarding claims 7 & 8: APA and Lee et al. also do not disclose wherein the alkyl ammonium salt is present an amount ranging from .01 to 10 wt % based on the CMP slurry (cl.7), or amount ranging from .01 to 1 wt% based on the CMP slurry (cl.8)

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Nojo et al. also disclose wherein the alkyl ammonium salt is present an amount ranging from .01 to 10 wt % or from .01 to 1 wt% on the CMP slurry is useful (col.4 lines 34-61).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate Nojo et al.'s alkyl ammonium salt presentation an very low rate concentration amount ranging on the CMP slurry, into the APA and Lee et al., to reduce the defects of the surface structure.

Regarding claim 11 & 12: APA and Lee et al. also do not disclose wherein the second slurry for an oxide film has a pH ranging from 2-7 (cl. 11); or has a pH ranging from 8-12 (cl.12).

Nojo et al. also disclose wherein the second slurry for an oxide film has a pH ranging from less than 8 (col. 3 lines 15-23); or has a pH ranging from 10-11.5 (col. 40-44).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate Nojo et al.'s basic pH range from less than 12, into the APA and Lee et al., to obtain an appropriated ratio of solvent solution in the enhancement removal of silicon layer.



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Regarding claim 16: APA and Lee et al. also do not disclose wherein the interlayer insulating film is selected from the group consisting of BPSG, PSG, FSG, PE-TEOS, PE-SiH<sub>4</sub>, HDP USG, HDP PSG and APL oxide (cl.16).

Nojo et al. also disclose wherein the interlayer insulating film is selected from the group consisting of BPSG (col.2 lines 19-29).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate Nojo et al.'s BPSG interlayer insulating film, into the APA and Lee et al., to obtain a low dielectric constant which is beneficial to chemical mechanical abrasive composition in either acidic or basic medium, in removing enhancement.

Claims 13 & 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Admitted Art (APA) in view of Lee et al. (US. 6,436,834B1) in view of Park (U.S. 6,573,186 B2).

APA and Lee et al. disclose substantially all of the claimed features , but do not disclose wherein the wordline conductive material is selected from the group consisting of doped silicon, poly silicon, tungsten, tungsten nitride, tungsten silicide and titanium silicide (claim 13); wherein the spacer of the wordline is formed by TEOS or silane based oxide film (cl.15).

Regarding claims 13 & 15: Park discloses a method of forming plug of semiconductor device having CMP, which include wherein the conductive material is

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selected from the group consisting poly silicon (col. 1 lines 25-27); wherein the spacers is formed of TEOS or silane based oxide film (col. 5 lines 23-29).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine Park's word line conductive material of poly silicon and having the TEOS or silane based oxide film spacers, into the APA and Lee et al., to obtain a high density and high melting material at high temperature.

Claims 14 & 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Admitted Art (APA) in view of Lee et al. (US. 6,436,834B1) in view of Tokunaga et al (US 6,309,980B1).

Regarding claims 14 & 17, APA does not disclose wherein the etching process using CCl<sub>4</sub> or Cl<sub>2</sub> gas (cl. 14); wherein contact hole is etched by using C<sub>4</sub>F<sub>8</sub>, C<sub>2</sub>F<sub>6</sub> or C<sub>3</sub>F<sub>8</sub> source (cl. 17).

Tokunaga et al. disclose the using Cl<sub>2</sub>, C<sub>4</sub>F<sub>8</sub> or C<sub>2</sub>F<sub>6</sub> for etching silicon film and contact hole of semiconductor device (col 5 lines 26-50 and col. 10 lines 30-54).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate Tokunaga et al.'s etching process using gas of Cl<sub>2</sub> and C<sub>4</sub>F<sub>8</sub>, C<sub>2</sub>F<sub>6</sub> into the APA and Lee et al.; to expect a better result in controlling the etching size, with selecting of any order of mixing ingredients.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Admitted Art (APA) in view of Lee et al. (US. 6,436,834B1) in view of Wolf (Vol.1 Silicon Processing for the VLSI-Era, pp. 176 & 177).

Regarding claim 18: APA and Lee et al. do not disclose wherein silicon layer is formed by doped silicon or poly silicon using  $\text{SiH}_4$  or  $\text{Si}_2\text{H}_6$  source (cl.18).

Wolf discloses the using etching gas  $\text{SiH}_4$  or  $\text{Si}_2\text{H}_6$  for forming silicon or polysilicon (p.176 & 177).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate Wolf's etching gas  $\text{SiH}_4$  or  $\text{Si}_2\text{H}_6$  for forming silicon by doped silicon or polysilicon, into the APA and Lee et al., to obtain high selectivity and uniform material to the nitride film, as well as control the etching size with selecting of any order of mixing ingredients.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yennhu B Huynh whose telephone number is 571-272-1692. The examiner can normally be reached on 8.30AM-7.00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on 571-272-1702. The fax phone numbers for the organization where this application or proceeding is assigned are 703-

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308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-7724.

YNBH,  
7/23/04

  
CARL WHITEHEAD, JR.  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800